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DAS Data Requirement 1

Demand Access System (DAS)
ITT Product Management Plan (PMP)

Revision A

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-	Released per ECF – AQ0001	07/24/00	W. E. Kearns
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CONTENTS

List of Exhibits

1. BACKGROUND

This section outlines the purpose and objectives of NASA's Demand Access System (DAS) project as well as the purpose and organization of this document.

DAS Purpose. The purpose of the DAS is to expand the existing Tracking and Data Relay Satellite System (TDRSS) Multiple Access Return (MAR) capabilities at a relatively low cost. The DAS will build on the ITT-developed Third Generation Beamformer Subsystem (TGBFS) by adding global system control and coordination functions, demodulation capabilities, and a data distribution network.

DAS Goals and Objectives. NASA's goals for the DAS are to provide immediate access to services by the customer, extended duration services, simplified resource allocation and operation, reduction of service cost, and new capabilities such as immediate science alerts, polling of spacecraft, and autonomous requests for MA service. Exhibit 1-1 incorporates NASA's objectives for DAS.

DAS Objectives
• Provide continuous, conflict-free DAS MAR services 24/7 upon customer demand.
• Transition DAS customer services between TDRSS satellites and terminals automatically.
• Support multiple, independent MAR services for TDRSS/SGLT/Ground Station configurations.
• Meet or exceed current MA return link communications performance (except for tie-ins with MA forward link).
• Provide demodulation and data distribution capabilities for DAS data services.
• Automate the operation of DAS return link services.
• Provide COTS data and control interfaces for DAS customers.
• Provide simple, low-cost, modular expansion capabilities for DAS services.

Exhibit 1-1: NASA's DAS Objectives

Overall Approach. NASA's overall approach is to establish a basic operational infrastructure, which may be expanded later as needs increase. Exhibit 1-2 provides an overview of the DAS reference architecture. The basic infrastructure will consist of the following:

- COTS optical switching capabilities to connect any Element Multiplexer Correlator (EMC) to any Independent Beamformer Unit Group (IBUG).
- Incorporation of a NASA-owned IBUG and addition of a new ITT COTS IBUG.
- A NASA specified MA receiver (which could be provided by ITT).
- A COTS IF switch capability to connect any IBU to any MA receiver.
- A COTS-based data archiving and distribution capability
- A comprehensive capability to control and monitor beamforming, demodulating, and data archiving and distribution functions.

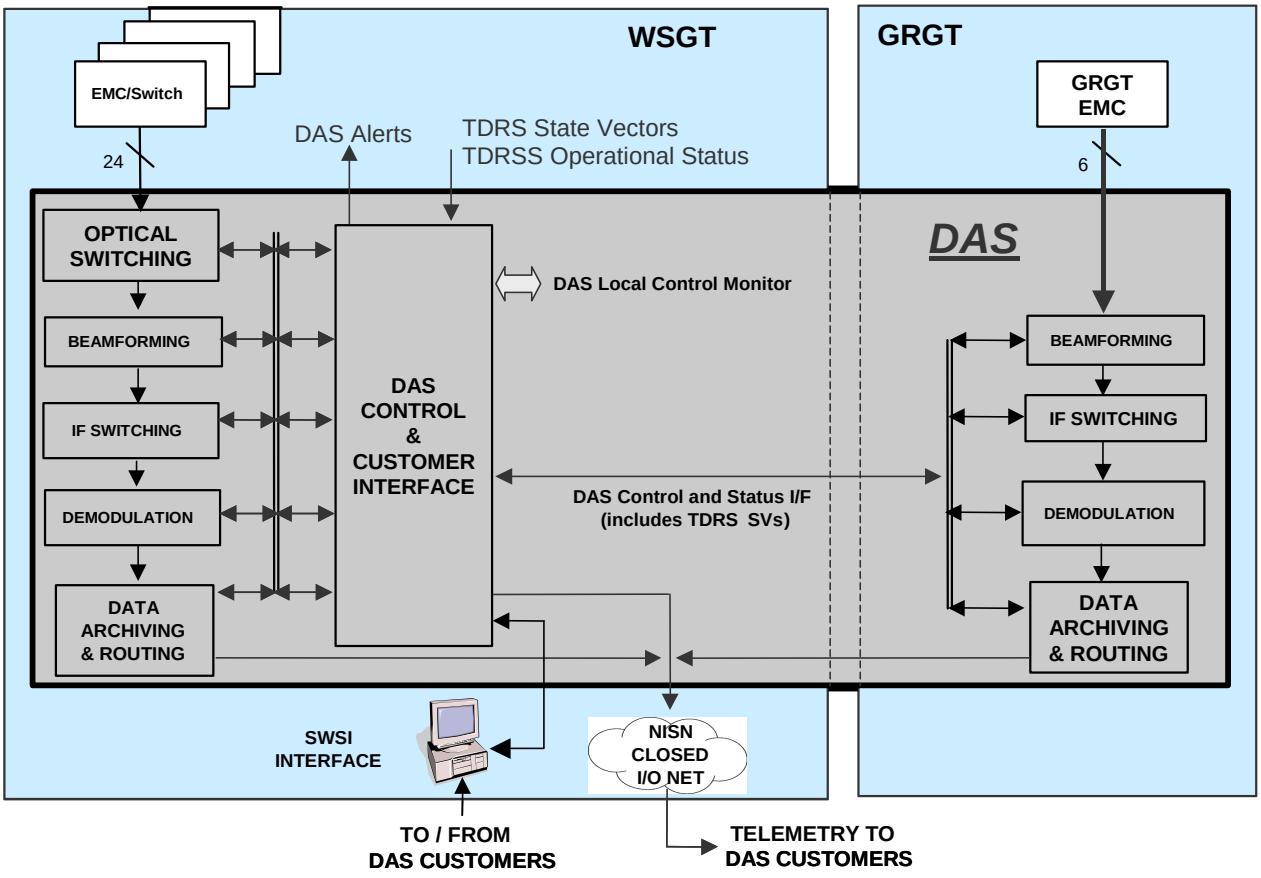

Exhibit 1-2: DAS Reference Architecture

1.1 PURPOSE

This Demand Access System Program Management Plan (PMP) describes and documents the organization, methodology and tools to be used in managing the DAS program. It also defines the Contract Work Breakdown Structure (WBS) established to plan, control, and measure all program activities and the Master Milestone Schedule and deliverables for accomplishing the program objectives. It will be revised when the Government and the Program Manager agree that sufficient changes have occurred to warrant modification.

1.2 SCOPE OF WORK

The DAS consists of hardware and software elements. The hardware includes incorporation and customization of COTS items and the modification of an existing ITT demodulator to incorporate new

modes and capabilities consistent with current MAR Services. The software includes modification of existing TGBFS WSC-controlled software, new computer operating systems and custom system control software designed and developed under this contract. These hardware and software items will be combined into suites of differing capabilities to be installed at the White Sands Ground Terminal and the Guam Regional Ground Terminal. Together, these suites under the master control of the WSC terminal will provide demand access capabilities for the TDRSS Multiple Access Return service.

1.3 CONTRACTOR RELATIONSHIPS

The DAS hardware and software will be developed, integrated and deployed by ITT Advanced Engineering and Sciences. Training and O&M manual development will be provided by ITT. NASA's WSC O&M contractor will install and test DAS at White Sands and Guam. ITT will support these efforts, overseeing installation and site testing activities. NASA's Space Network Web Based Services Interface (SWSI) Project Team will develop the planning and scheduling interface for DAS customers. When completed, SWSI will act as the interface point for DAS. ITT will support the SWSI project team, developing a DAS—SWSI ICD governing the exchange of data between DAS and SWSI.

1.4 APPLICABLE DOCUMENTS

The following documents guide the DAS program.

1.4.1 Compliance Documents

- DAS Systems Requirements Document, draft, 15 October 2000
- DAS Operations Concept Document, draft, 15 October 2000
- DAS—WSC Interface Control Document, draft, 06 December 2000
- DAS—Customer Interface Control Document, draft, date TBD
- DAS—SN Web-based Service Interface (SWSI) Interface Control Document, draft, date TBD

1.4.2 Guidance Documents

- NASA DAS Project Management Plan, draft, 31 May 2000
- NASA DAS Project Commitment Document, 2 March 2000
- ITT AES Communication-Electronics Systems Laboratory Quality Manual, latest revision, in lieu of a program unique Configuration Management Plan and Quality Assurance Plan.
- DAS Program Schedule, issued separately

1.5 PROGRAM MANAGEMENT PLAN ORGANIZATION

This document is organized as follows:

- Section 1 provides background information.
- Section 2 provides ITT's control organization and data on the hierarchy of plans.
- Section 3 provides ITT's overall management approach.
- Appendices provide amplifying information.

2. CONTROL ORGANIZATION

This section defines the ITT project organization implementing its DAS development and deployments efforts, its relationship to corporate management, and its delegated authority and responsibilities.

2.1 PROGRAM ORGANIZATION

ITT's Advanced Engineering and Science will perform all work for the DAS program, except actual installation and site testing. There are no subcontractors. NASA's CSOC Contractor and NASA's WSC O&M Contractor will perform DAS installation and site testing under separate NASA contracts. There will be an "associate" Contractor cooperative relationship between ITT and NASA's other contractor's in which ITT will cooperate with these contractors in developing the site preparation and installation plans and in overseeing their efforts to install and test the DAS system at NASA's White Sands Ground Terminal and at the Guam Remote Ground Terminal. However, ITT is not responsible for the efforts of these associate Contractors' cost, schedule or technical performance.

NASA's SWSI project team will develop the DAS customer interface. When completed SWSI will be the interface point for DAS customers. ITT will cooperate with the SWSI team, coordinating customer interface requirements and developing a DAS—SWSI ICD to govern the exchange of customer planning, scheduling and operational performance data between DAS and SWSI. However, ITT is not responsible for the SWSI team's cost, schedule or technical performance.

ITT is responsible for the DAS work as identified in the CWBS.

2.2 PROGRAM MANAGEMENT ORGANIZATION

Exhibit 2-1 shows the management structure established for the DAS program by the Communication Systems Integration (CSI) Group, an element of the ITT Defense's Advanced Engineering & Sciences Division. The Program Manager reports to the CSI Director of Communication Sciences. The program Quality Manager reports directly to the Director of the CSI CES Laboratory. Program Control and Financial Management Support is provided via the CSI Director of Contract Administration. Exhibit 2-1 shows our organization for the DAS program and names all the key leaders committed to this effort. This program organization has direct access to the ITT AES Executive Management. All key personnel work for Dr. Aaron Weinberg. Each was chosen for the critical skills and experience, both technical and managerial, gained in previous related efforts.

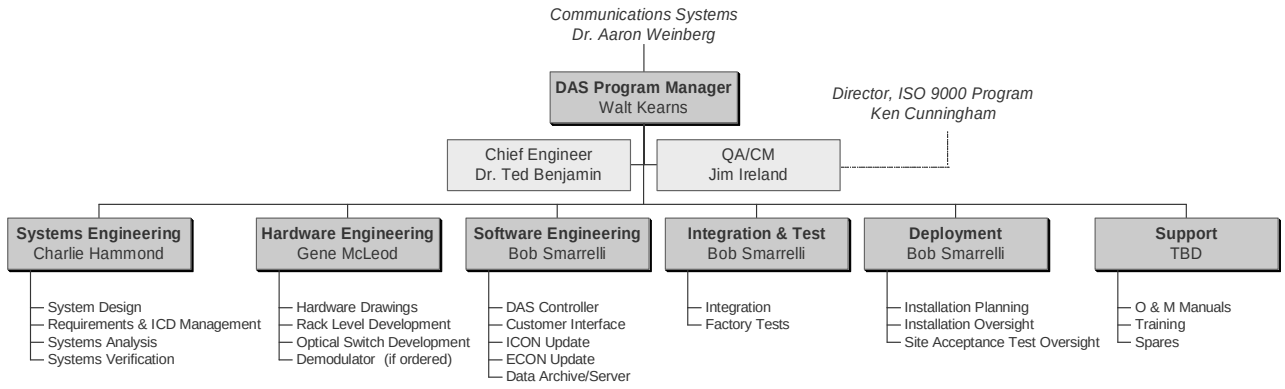

Exhibit 2-1: ITT Organization for the DAS Project

2.3 MANAGEMENT AUTHORITY AND RESPONSIBILITY

The program manager, Mr. Walt Kearns, is authorized by Mr. Len Schuchman, President of ITT AES's CSI Group, to expend resources within limits of the contract authorization and is authorized direct immediate access to ITT AES senior management, contract administrators and cost analysts. He is responsible for the overall program planning, control and direction. He is accountable for overall contract technical, cost and schedule performance and is authorized to reassign program resources to resolve technical problems and solve resource conflicts. He is authorized to coordinate with senior management to ensure corporate resources are properly allocated to successfully achieve NASA's DAS objectives. He has been delegated specific authority and responsibility to:

- Conduct progress and status reviews; approve all deliverables
- Supervise the engineering managers
- Assign tasks to the engineering managers
- Approve work plans developed by the engineering managers
- Allocate and re-allocate resources to the engineering managers to ensure the program objectives are met
- Approve end items for delivery to NASA
- Act as the primary point of contact with NASA on the DAS program.

Each of the engineering managers - Mr. Charlie Hammond, Mr. Gene McLeod, and Mr. Bob Smarrelli - is authorized to expend resources assigned to their efforts. They have direct access to the program manager and are authorized direct access to ITT AES contract administrators and cost analysts. They have been delegated specific authority and responsibility to:

- Develop innovative and creative solutions in meeting the DAS program objectives

- Prepare work plans for their assigned areas
- Execute work plans in conformance with ITT AES quality and configuration management policies
- Manage their technical responsibilities within the allocated resources
- Monitor and report technical, cost and schedule progress
- Allocate and re-allocate assigned resources to ensure their task objectives are met
- Identify technical, cost and schedule issues and develop remedial plans
- Supervise assigned team members
- Deliver end items in time for internal review prior to delivery to NASA
- Coordinate with NASA's DAS manager on issues within their assigned areas.

2.4 RELATIONSHIP TO OTHER PLANS

This plan is subordinate to the NASA DAS Product Management Plan.

All other ITT-developed DAS related work plans and other documentation are subordinate to this plan and will be developed and maintained in accordance with the ITT AES Reston Communications and Electronic Systems Lab Quality Manual and Procedures.

3. OVERALL MANAGEMENT APPROACH

This section defines ITT's overall approach for managing the development of the DAS product. ITT's approach includes the following components:

- ***Product Requirements.*** Section 3.1 provides a summary of DAS product requirements as currently defined in the DAS Systems Requirements Document (SRD). ITT will use the current version[1] for planning purposes and will ensure that, as changes are made, they are expeditiously reflected in DAS development processes and documents.
- ***Performance Control.*** Section 3.2 identifies the planning, measurement, reporting and change control techniques used to management the program and to ensure technical, schedule and cost performance.
- ***Work Breakdown Structure (WBS).*** Section 3.3 provides the DAS work breakdown structure (WBS) that defines ITT's tasks and subtasks to be performed during development of the DAS product. The WBS defines the work that ITT must accomplish.
- ***Program Deliverables.*** Section 3.4 identifies the deliverables to be provided by ITT under the DAS program.
- ***Staff Loading and Workflow.*** Section 3.5 provides the planned staff loading workflow to accomplish DAS tasks and subtasks.
- ***Risk Management.*** Section 3.6 provides a description of the risk management methodology that ITT will apply to DAS. ITT will concentrate on identifying, quantifying, and mitigating technical, schedule, and cost risks.
- ***Life Cycle Cost (LCC).*** Section 3.7 provides ITT's life cycle cost (LCC) approach for the DAS project.
- ***Productivity.*** Section 3.8 provides ITT's approach for specifying and measuring productivity during the DAS development.
- ***NASA Interfaces.*** Section 3.9 provides ITT's approach for interfacing with NASA.
- ***Product Assurance.*** Section 3.10 provides ITT's approach for assuring the quality of the DAS product.
- ***System Integration.*** Section 3.11 provides ITT's approach for integrating the DAS subsystems into the DAS system.

[1] DAS System Requirements Document (SRD).

3.1 PRODUCT REQUIREMENTS [2]

ITT's responsibilities for meeting NASA's requirements in developing the DAS product are summarized as follows:

1. ITT will be responsible for developing the initial DAS infrastructure to include:
   - Full functionality as defined in the DAS SRD and Concept of Operations
   - Limited, but expandable, beamforming capacity
   - Limited, but expandable, receiver capacity
   - Full switching, control, and data distribution functions
   - Operation and Maintenance (O&M) Manuals
   - Training to Level 0 and 1 for the overall system and to Level 2 for the demodulator and software subsystems.
2. ITT will perform program management, quality assurance, configuration management, and system and support engineering functions to complete DAS development and fielding.
3. ITT will use best commercial practices to develop configuration items (CIs) to commercial standards. There are limited exceptions, in which STDN specifications will be used (principally in rack designs and layouts).
4. ITT will provide most documentation in contractor format to commercial standards. Minor exceptions or interpretations include the following:
   - In the case of hardware design drawings, the DID specifies that they "shall be prepared as described in Section 2 of the Standard for Product Data Packages (500-TIP-3109), [GSFC MO&DSD, May 1994.]" ITT plans to deliver hardware design drawings in accordance with the provisions of Section 2.4 of 500-TIP-3109, (Title: Class-2 Engineering Drawings) which states that "Class-2 engineering drawings shall be prepared on the COTS vendor's engineering drawing formats unless otherwise directed by CDRL, DID, or other form of agreement."
   - In the case of Deviation and Waiver Requests specified in DRL No. 9, ITT will use the forms and procedures specified by ITT's ISO9001 Quality Manual in Op-05-05.
5. ITT will assist the Consolidated Space Operations Contract (CSOC) contractor in developing installation plans and performing installation and network testing.

3.2 PROGRAM PERFORMANCE CONTROL

Control of DAS program performance is exercised through planning, performance measurement and performance reporting processes that are compliant with establish ITT AES policies and procedures.

[2] For quick reference, Appendix A provides a summary of the product requirements specified in the DAS SRD and Concept of Operations.

Management control will be maintained for each of the three basic program parameters: 1) technical performance; 2) schedule performance; and 3) cost performance. The planning, performance measurement, reporting and change control for each of the three basic program parameters are addressed below.

3.2.1 Technical Performance

The DAS Systems Requirements Document, the DAS Operations Concept Document, the DAS—WSC ICD, DAS—SWSI ICD and the DAS—Customer ICD define compliant technical performance. Both documents will be clarified and defined in more detail by the systems Requirements Review and through the systems engineering process. The Lead Systems Engineer is responsible for ensuring that all "shall" requirements in the SRD and OCD are met. The lead Systems Engineer is also responsible for reviewing and approving all "derived" requirements.

3.2.1.1 Technical Planning

Five steps will be taken to ensure technical compliance:

- ITT will prepare and maintain a Performance Verification Matrix (PVM), identifying all specific requirements, traceable to their original SRD/OCD source, to be met by the delivered system.
- ITT will design the overall DAS to address all the requirements listed in the PVM. As the design evolves, all technical requirements will be allocated to a system-level component in the PVM.
- ITT will develop a system-level design and the design will be documented in a Detailed System/Subsystem Specification.
- ITT will define an Acceptance Test Plan and Test Procedure document to verify the performance of the system in accordance with the PVM. A specific verification will be allocated to each technical requirement in the PVM.
- ITT will test the DAS in a Factory Acceptance Test prior to delivery and, after installation at WSC and Guam, will oversee the site acceptance tests and network tests in accordance with Government-approved test plans. Successful completion of each test will be recorded in the PVM as each requirement is successfully tested, thereby completing traceability from the technical requirement to the evidence of successful performance.

ITT will design appropriate work products for each step of the design and development process to ensure a rigorous technical development process and to provide a means of monitoring and measuring technical performance throughout the development process. Such products include design documents, software development folders, screen displays and tests cases. The Government is invited to review any of these work products.

3.2.1.2 Technical Measurement

Technical performance will be measured throughout the development process by assessing the accuracy and completeness of pre-defined interim design and development work products as criteria established by the Lead Systems Engineer. At a minimum, the work products to be evaluated include:

- DRLs—All deliverable documentation addressing technical activities will be evaluated by the DAS Program Manager, Chief Engineer and Lead Systems Engineer as well as by Government personnel.
- Internal Detailed Designs—Non-deliverable design work product documentation defining the system, configuration items, software designs and man-machine-interfaces will be reviewed by the DAS Program Manager, Chief Engineer and Lead Systems Engineer during scheduled internal design meetings. The Government is invited to participate in any of these reviews.
- Software Design Walkthroughs—Software development walkthroughs by the DAS Program Manager, Chief Engineer, Lead Systems Engineer and Lead Software Engineer will be held prior to initiating unit coding and upon completion of unit code testing and CSC testing. The Government is invited to participate in any of these walkthroughs.
- Formal Design Reviews—Formal, contractually required reviews (Preliminary Design Review, Critical Design Review and Test Readiness Review) will be held to provide the Government an opportunity to review detailed specific design progress.
- Prototypes—Where appropriate, prototype portions of the DAS will be developed and reviewed by the DAS Program Manager, Chief Engineer and Lead Systems Engineer to verify designs and performance compliance.

Specific DAS program personnel are charged with monitoring or auditing technical activities for compliance with contractual requirements and ITT standards:

- The Lead Systems Engineer is charged with ensuring full compliance of the delivered DAS with the SRD/OCD and other technical requirements documents. The Lead Systems Engineer ensures the traceability of all technical requirements through all work products to final acceptance, All technical DRL deliverables will be reviewed and approved by the Lead Systems Engineer and the Program Manager.
- The Configuration Manager is charged with establishing and controlling technical baselines and the traceability of versions and changes and with monitoring configuration management compliance with the ITT AES CES ISO-9001 Quality Manual.

The Quality Assurance Manager is charged with an independent assessment of the contractual compliance of all deliverables. The QA Manager is also charged with monitoring quality assurance compliance with the ITT AES CES ISO-9001 Quality Manual.

3.2.1.3 Technical Reporting

The Program Manager will receive weekly reports to maintain an overview of technical performance:

- Chief Engineer—Reports technical issues to be addressed to ensure technical performance compliance; arbitrates issues regarding interpretation of requirements and identifies inconsistencies in addressing technical requirements between functional areas.
- Lead Systems, Hardware, Software and Integration/Test Engineers—Report problems encountered, corrective actions taken, and technical milestones achieved as well as plans for the next week.
- Configuration Manager—Reports problems in configuration control and configuration change control and corrective action taken.
- Quality Assurance Manager—Reports problems in quality assurance compliance and corrective actions taken.

The Program Manager consolidates this information and reports on the status and quality of the program technical performance in monthly technical evaluation reports to corporate management and reports to the Government program manager technical status, progress and issues monthly.

3.2.1.4 Technical Change Control

Changes to the technical requirements baseline must be defined in writing and approved by the program Change Control Board in accordance with configuration management procedures in the ITT AES CES Laboratory ISO-9001 Quality Manual. Upon approval by the CCB, all technical leaders will be advised in writing and all pertinent baseline documents and work products will be modified to incorporate the approved change.

The Configuration Manager will reflect approved changes in the program CM files and the Quality Assurance Manager will verify that the approved changes are correctly reflected in the technical baseline documents and affected work products in accordance with the Quality Manual.

3.2.2 Schedule Performance

A top-level DAS Master Program Schedule will be established and maintained, using Microsoft Project, based on contractually required delivery dates and on the schedule requirements and interrelationships of the DAS WBS elements. This Master Schedule is published separately in accordance with DRL 4, but is considered part of this Management Plan. It will be used to develop all lower-level detailed schedules for lower level WBS elements.

3.2.2.1 Schedule Planning

A timeline will be developed for each WBS element defining element start and stop dates. Elements of more than one-month duration will be broken down into successively lower-level work packages or into intermediate work packages with measurable milestones at intervals of approximately one month. These packages become the basis for cost versus schedule performance analysis, such as Earned Value

calculations. Note: Earned Value calculations are required for these efforts and are not being being performed.

The technical Lead Engineers will develop their detailed schedules for review by the Chief Engineer and PM prior to approval by the PM.

3.2.2.2 Schedule Measurement

Progress will be measured against planned progress on a monthly basis. Lead Engineers will advise the PM each week which WBS elements, work packages, and work package milestones have been completed. The QA manager will review these reports and either confirm or comment, noting any deficiencies. A work package will be considered complete only if no open action actions or product deficiencies exist. The PM will annotate the Master Schedule to reflect all WBS elements completed.

3.2.2.3 Schedule Reporting

Schedule performance is reported as follows:

- The PM will maintain a list of work packages and WBS elements not completed on schedule and ensure the baseline Master Schedule is updated weekly to show current status.
- The PM estimates Earned Value on a monthly basis.
- Schedule status is reported monthly to ITT corporate management.
- Schedule status is included in the monthly status reports to the Government.

3.2.2.4 Schedule Change Control

The baseline Master Schedule may not be changed without the approval of the PM and the concurrence of the Government. Nor may any subservient schedules be changed to the extent they would create a change in the baseline Master Schedule without approval of the PM and concurrence of the Government.

The Government, or the program Lead Engineers can initiate changes to the baseline Master Schedule:

- The Government may contractually direct a baseline schedule change. Any changes resulting from approved Engineering Change Proposals are considered Government-directed changes.
- Lead Engineers may request a baseline schedule change via internal memo to the PM. Defining the requested change, explaining the requested change and completing the necessary ECP forms as defined in the ISO-9001 Quality Manual.

Approved changes will be incorporated into the baseline by the PM, by updating the Master Schedule and associated documentation and in accordance with the ECP processes advising all affected parties.

3.2.3 Cost Performance

The Program Manager is charged with creating all expenditure plans, with the assistance of each Lead Engineer, measuring actual expenditures against plans and providing monthly expenditure reports to corporate management and to the Government.

3.2.3.1 Cost Planning

The initial budget baseline is derived from the basis of estimate established for each WBS element in the cost proposal. This baseline is adjusted for approved ECPs and other changes approved by the Government. The timing of the expenditures for each WBS element is planned to match the Master Program Schedule. As a result, a total expenditure plan for the program is developed showing monthly projected expenditures for labor, materials, subcontracts, and other direct costs. It can also be used to establish Percent Completion plans and the projected monthly and cumulative percent completion plans that can be measured against actual expenditures.

3.2.3.2 Cost Measurement

Resource expenditures are measured in terms of dollars and labor hours. Labor hours and dollars are reported weekly to the Program Manager and all Lead Engineers by the ITT time and cost entry system. Subcontractors, if any are used, submit weekly reports. The PM compares reported labor hours staffing against planned staffing and reported labor and ODC dollars against planned costs to assess planned versus actual expenditures.

Actual monthly and cumulative costs are compared to projected costs for the following categories:

- Total Program Costs
- Subcontractor Costs (if applicable), total and by subcontractor.
- Labor Costs
- Material Costs
- ODCs

Acceptable monthly and cumulative variances levels are established by the PM, generally in the 5-10% range. Variances in excess of established thresholds will be assessed by the PM who will request analysis and explanation, with a recovery plan when appropriate, from the subcontracts manager or the appropriate Lead Engineer.

3.2.3.3 Cost Reporting

Corporate finance is responsible for preparing all cost reports. The following reports are provided to the PM.

- Weekly and Cumulative Labor Hours and Labor Dollars
- Monthly
    - ◊ Financial Status Report for approval prior to submission to the Government
    - ◊ Program management reports for approval prior to submission to ITT management.

3.2.3.4 Cost Change Control

Changes to the baseline budget may be generated by approved ECPs and other contract modifications. Internal revision of cost estimates will not result in a change to baseline budgets, but will result in an adjustment to the Estimated Cost at Completion (EAC).

No changes in the baseline budgets or in the EAC may be made without approval of the PM.

3.3 WORK BREAKDOWN STRUCTURE

All of the technical and managerial activities for this effort are identified in Exhibit 3-1, DAS Work Breakdown Structure (WBS). This structure reflects the logical breakout of all program tasks to the first two levels. In conjunction with the associated WBS Data Dictionary, provided in Appendix B, the structure addresses all program requirements. The WBS serves as the baseline to plan, manage and control all program work activities. Exhibit 3-1 provides an overview of ITT's work breakdown structure (WBS) and responsibility assignment matrix for the development of the DAS product.

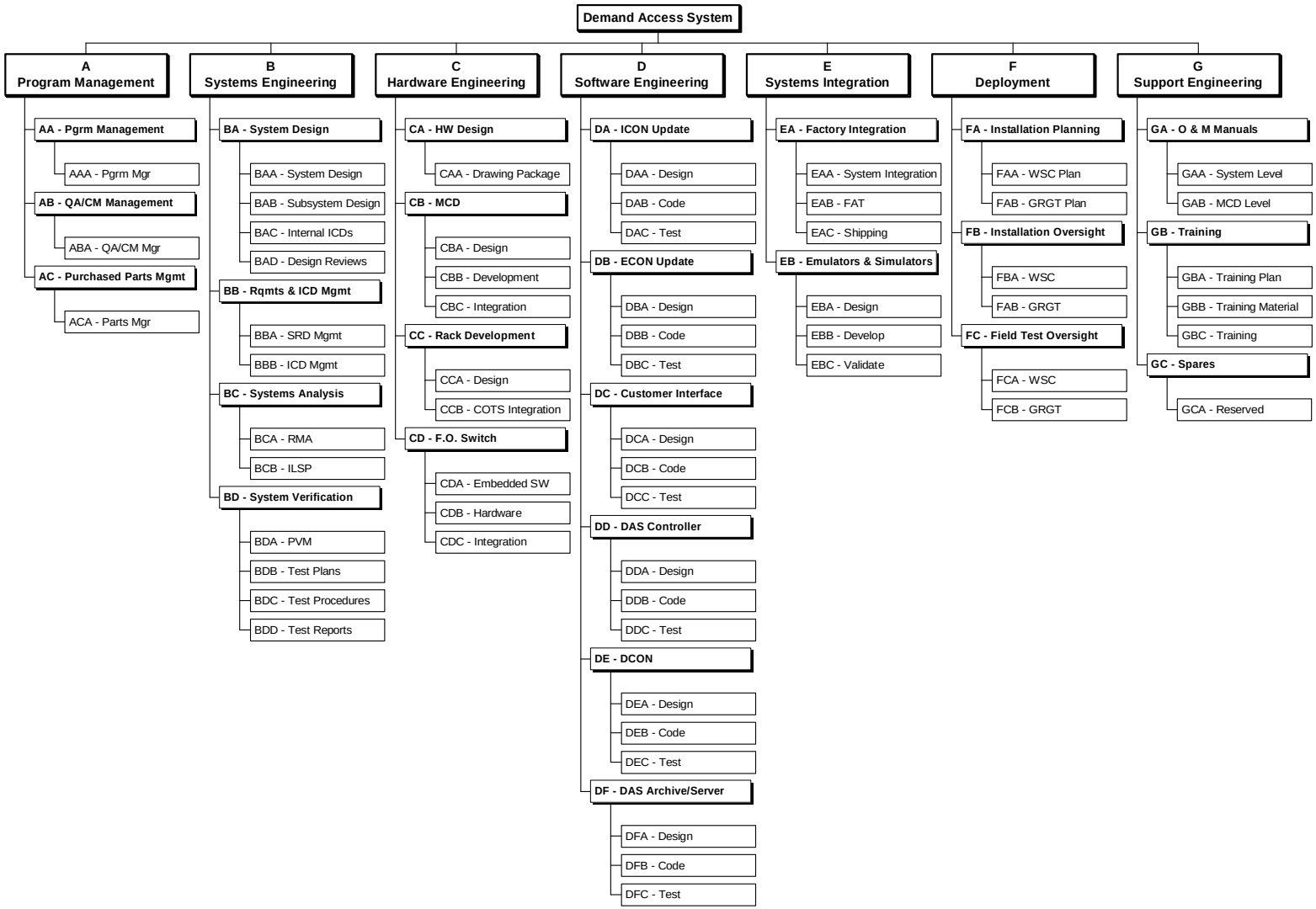

Exhibit 3-1: ITT's Work Breakdown Structure for DAS Development

3.4 PROGRAM DELIVERABLES

The DAS program will generate three types of deliverables:

- An integrated system, consisting of hardware and software, to perform the functions defined by the DAS Systems Requirements Document. This is the key deliverable is the Demand Access System, consisting of:
  - ◊ Control Subsystem (WSC only).
  - ◊ Optical Switch Subsystem (WSC only).
  - ◊ Two COTS IBUGs, with the existing NASA IBUG to be integrated at the Guam Remote Ground Terminal (GRGT).
  - ◊ IF Switching Subsystem.
  - ◊ Receiver Subsystem
  - ◊ Archiving and Data Distribution Subsystem.
- Technical services to support the operations and maintenance of the DAS after delivery. Two types of services will be provided:
  - ◊ Operational training will be provided for WSC and Guam ground station personnel designated by the Government.
  - ◊ Level 2 hardware and software maintenance training will be provided for WSC ground station personnel designated by the Government.
- Documentation in accordance with draft Data Requirements List (DRL) dated 15 May 2000. This documentation is defined in Exhibit 3-2. This exhibit also identifies the contractually defined delivery schedules and applicable Data Item Descriptions (DID).

ITT will deliver two systems:

- The master system to NASA's White Sands Complex, where it will be installed in the White Sands Ground Terminal (WSGT).
- The second system will be delivered to the GRGT with a limited local-control-only subset of the full control subsystem.
- NASA M&O ground station personnel will perform installation of both systems with ITT oversight.

Exhibit 3-2 provides an overview of required data deliverables and their scheduled delivery dates.

DRL No.	Title	Due Dates	
		Draft	**Final**
1	Product Management Plan (PMP)	SRR	SRR +30 days
2	Configuration Management (CM) Plan **(Note 1)**		
3	Quality Assurance (QA) Plan **(Note 1)**		
4	Product Schedule (updates at MSRs)	SRR -45 days	PDR -30 days
5	Monthly Status Reviews (MSRs)	Monthly, 3rd or 4th Wednesday of the following month	
6	Detailed System/Subsystem Specification	PDR	CDR
7	Internal Interface Control Document	PDR	CDR
8	Software Design Documentation	CDR +90 days	ORR -30 days
9	Hardware Design Drawings	CDR +90 days	ORR -30 days
10	Site Preparation and Installation Plan	TRR -60 days	TRR -30 days
11	Acceptance Test Plan & Procedures • System Test Plan • Subsystem Test Plan • Test Procedures	 • CDR • CDR +60 days • CDR +150 days	 • CDR +30 days • CDR +90 days • CDR +210 days
12	Performance Verification Matrix	Updated continually throughout the project	15 days after completion of verification program
13	Acceptance Test Report	Test completion +15 days	ORR
14	Inspection and Analysis Report	Test completion +15 days	ORR
15	Deviation and Waiver Requests **(Note 1)**	Deviation. Requests: CDR	Waiver Requests: with Test Report
16	Reliability, Maintainability, and Availability (RMA) Analysis Report	PDR	CDR
17	Operations and Maintenance Manual	TRR -30 days	TRR
18	Training Plan and Materials	• Plan: TRR -30days • Materials: TRR	• TRR • TRR +30 days
19	Integrated Logistics Support Plan	PDR	CDR
Notes: 1. ITT's Quality Manual will be used.			

Exhibit 3-2: Required DAS Data Item Deliverables

3.5 WORKFLOW AND STAFF LOADING

DAS is funded as a Time and Materials (T&M) Task Order, under NASA's NMSP RF Communication Systems Engineering Contract, ITT Job 5500. Exhibit 3-3 provides a summary of the staff loading.

WBS Element	FY 00 Hours	% of FY 00 Hrs	FY 01 Hours	% of FY 01 Hrs	FY 02 Hours	% of FY 02 Hrs	Total Hours	% of Total Hrs
A Program Management	**1,643**	**14%**	**3,996**	**10%**	**1,569**	**14%**	**7,208**	**11%**
AA Program Manager	736		2,340		780		3,856	
AB CM/QA Manager	515		936		468		1,919	
AC Parts Manager	392		720		321		1,433	
B Systems Engineering	**3,694**	**31%**	**4,639**	**11%**	**1,720**	**16%**	**10,053**	**16%**
BA System Design	2,694		1,362		160		4,216	
BB Rqmts & ICD Mgmt	160		468		160		788	
BC System Analysis	490		468		-		958	
BD System Verification	350		2,341		1,400		4,091	
C Hardware Engineering	**3,507**	**29%**	**11,126**	**27%**	**-**	**0%**	**14,634**	**23%**
CA Design Documents	548		700		-		1,248	
CB Demod Development	667		6,746		-		7,413	
CC Rack Level Developmer	1,310		2,140		-		3,450	
CD Optical Switch Developn	982		1,540		-		2,522	
D Software Engineering	**3,228**	**27%**	**13,344**	**32%**	**2,032**	**18%**	**18,605**	**29%**
DA Update ECON	290		790		-		1,080	
DB Update ICON	288		790		-		1,078	
DC Customer Interfce	240		760		-		1,000	
DD DAS Controller	1,650		7,200		2,032		10,882	
DE DEMOD Controller	400		1,120		-		1,520	
DF Archive/Server	360		2,684		-		3,044	
E Systems Integration	**-**	**0%**	**3,784**	**9%**	**2,228**	**20%**	**6,012**	**9%**
EA Factory Integration	-		3,160		2,228		5,388	
EB Emulators & Simulators	-		624		-		624	
F Deployment	**-**	**0%**	**312**	**1%**	**956**	**9%**	**1,268**	**2%**
FA Installation Planning	-		321		156		477	
FB Installation Oversight	-		-		332		332	
FC Field Test Oversight	-		-		468		468	
G Support Engineering	**-**	**0%**	**4,148**	**10%**	**2,572**	**23%**	**6,720**	**10%**
GA O&M Manuals	-		2,340		540		2,880	
GB Training Plan/Materials	-		1,808		1,408		3,216	
GC Training	-		-		624		624	
Grand Totals	**12,072**	**100%**	**41,349**	**100%**	**11,077**	**100%**	**64,500**	**100%**

Exhibit 3-3: Staff Loading

Exhibit 3-4 provides an overview of the planned workflow.

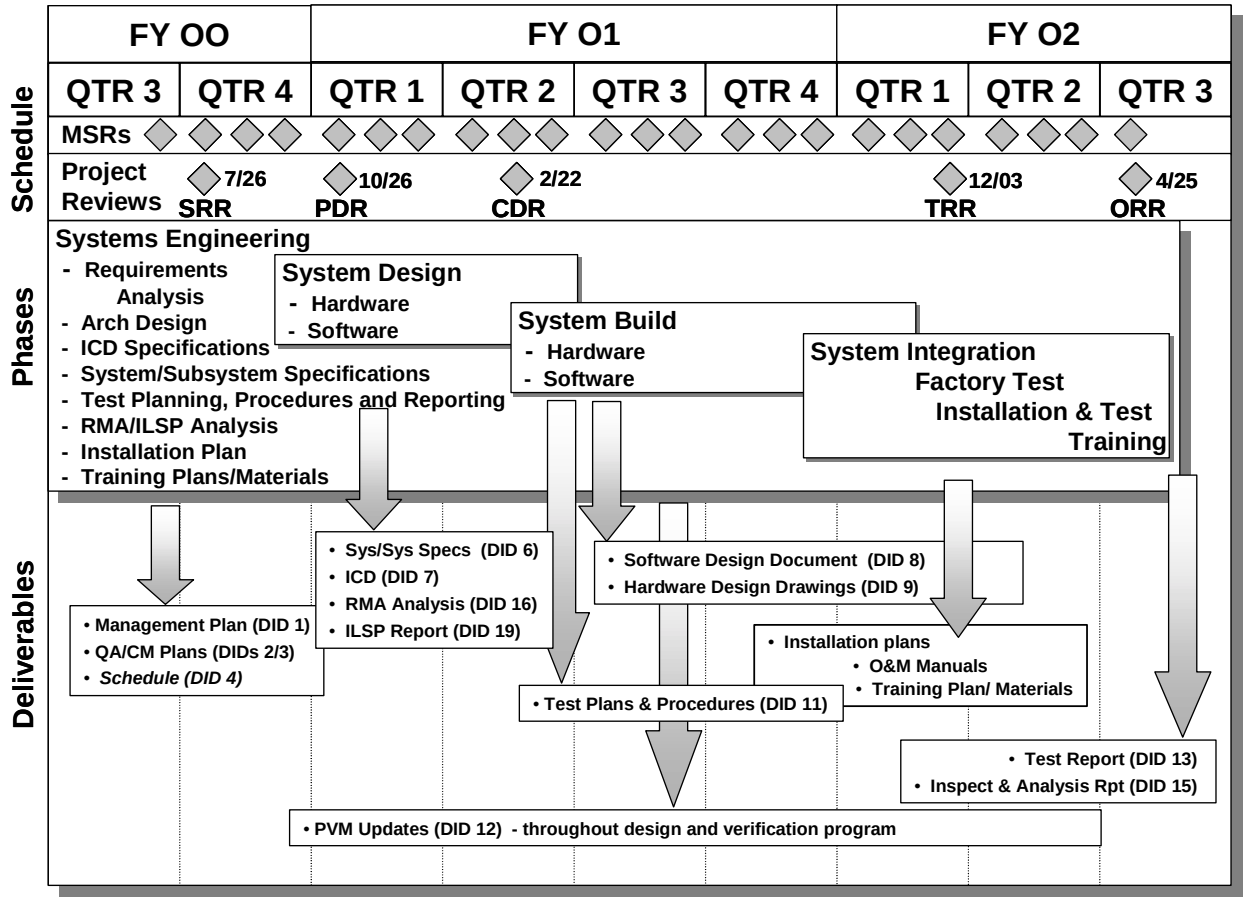

Exhibit 3-4: Logical Workflow for DAS

3.6 RISK MANAGEMENT

The objective of ITT's risk management activities is to reduce each identified risk to a low level by performing appropriate risk mitigation activities. Overall responsibility resides with the Program Manager. Risk Management is a continuous process, comprised of four steps:

- Step 1: Identify Risks—Risks may related to cost, schedule or technical performance and can be identified by any member of the DAS team or by Government representatives participating in the program at any time. Possible risks are documented on a Risk Identification form, which is maintained on-line in the program electronic notebook. Forms are submitted to the PM.

- Step 2: Assess the Risk—The PM evaluates each risk, with the assistance of the Chief Engineer, and makes a preliminary assessment of its validity and priority. The final assessment of validity and priority is a collaborative decision between the PM and the program Lead Engineers.

- Step 3: Develop Risk Mitigation Plans—A plan will be developed for the mitigation or elimination of each identified risk. Plans are developed in order of priority; ideally at the same collaborative meeting convened to assess each risk and assign risk priorities. Each plan includes

a definition of the risk, mitigation tasks, a completion schedule and identification of the person responsible.

- Step 4: Resolution—The PM monitors the progress of risk mitigation activities with assistance of the QA manager in accordance with the Quality Manual.

The PM provides a monthly report identifying all unresolved risks to the Government.

3.7 LIFE CYCLE COST (LCC) APPROACH

ITT has incorporated a life cycle cost (LCC) approach in developing the DAS. This approach includes the following activities:

- In assessing design options for CIs and subsystems, ITT will use LCC as an independent variable, i.e., will estimate the LCC of each design option as a criterion separate from any technical criteria.
- In developing the Integrated Logistics Support Plan (ILSP), ITT will use the results of DAS RMA analyses to recommend those maintenance and spare parts provisioning methods and procedures that result in the lowest estimated LCC while meeting the DAS RMA requirements.

3.8 PRODUCTIVITY APPROACH

Exhibit 3-5 provides an overview of ITT's standardized formal productivity controls. For the DAS Program, ITT has initiated the following activities to measure productivity:

- Cost controls were put in place on 15 May, 2000 when cost accounts were established for each WBS element and charge numbers were published to the ITT DAS development team
- An up-to-date DAS cost account list is available to DAS team member on the local server
- The ITT DAS PM issued initial ITT Work Authorization Documents (WADs) to each Task Leader (TL) as management's formal go-ahead to start work
- As costs accumulate, the assigned Financial Analyst provides a detailed weekly financial status report to the PM and each TL
- Each week, the PM conducts a formal status review with both technical and financial leaders where the status of planned vs. actual expenditures is discussed
- Each month, the PM participates in formal business area review meetings where each PM reports to upper ITT management on program productivity and detailed technical, schedule, and cost status.

3.9 NASA INTERFACE APPROACH

The primary interface for the DAS development program will be as specified in the NASA DAS Product Management Plan.[3] The GSFC DAS Product Manager, Mr. Tom Gitlin, is the primary NASA interface for ITT's Implementation Program Manager, Mr. Walt Kearns. Mr. Kearns will interface with Mr. Gitlin on all DAS development matters. ITT personnel on the DAS development team will only interface with NASA personnel on DAS matters as specifically authorized by Mr. Gitlin or NASA personnel whom he has specifically authorized to act on his behalf.

[3] Demand Access System Product Management Plan (Draft) (451-DAS-PMP), GSFC Network and Mission Services Program, 31 May 2000.

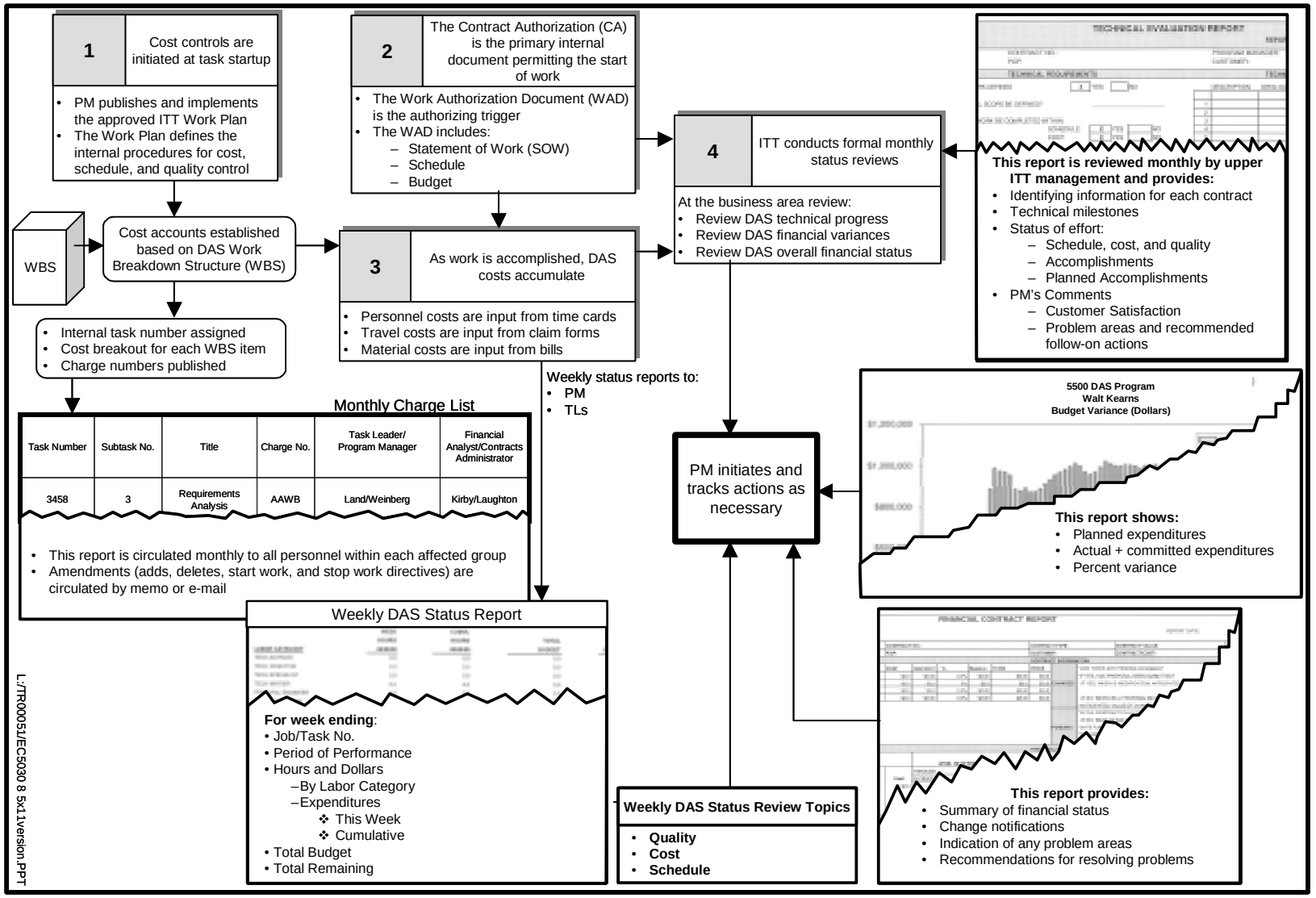

Exhibit 3-5: ITT's Standardized Productivity Reporting and Control Procedures

3.10 PRODUCT ASSURANCE APPROACH

ITT will adhere to the performance assurance precepts outlined in Section 14 of the NASA DAS Product Management Plan. Specifically:

- ITT will use the Performance Verification Matrix (PVM) as the primary tool to relate NASA's requirements for DAS as defined in the SRD and the Concept of Operations to the verification methods that ITT will use or recommend for use to verify that each requirement has been met. For each requirement included in the PVM, ITT will provide the 12 data elements specified in DID 12, Performance Verification Matrix.
- ITT will develop test plans and procedures as specified in DID 11, Acceptance Test Plan and Procedures for acceptance, system/subsystem, unit, and software tests.
- ITT will formally document the results of all tests as specified in DID13, Acceptance Test Report, and DID 14, Inspection and Analysis Report.
- ITT will submit product data item deliverables for review by the NASA DAS Product Manager as specified in the DAS Data Item Descriptions. ITT will provide a status report on product deliverables at each MSR.

3.11 SYSTEM INTEGRATION APPROACH

ITT's approach for integrating DAS subsystems into the DAS system includes the following activities:

- During the production phase, ITT will assemble DAS subsystems from the bottom up: elements at the lowest level of the system hierarchy will be integrated and tested first.
- ITT will identify the elements at the lowest level of the system hierarchy that will be integrated and tested first. This identification will be:
    - ◊ Performed initially during system design (WBS Element BA), where the system hierarchy will be defined in the system/subsystem specifications.
    - ◊ Carried forward into system verification (WBS Element BD), where appropriate tests and procedures will be defined for each component, sub-assembly, CI assembly, and groupings of CI assemblies.
- ITT will structure DAS test plans to work up the system hierarchy with discrepancy reporting and corrective at each test level. The single mandatory exit criterion from one level of testing to the next higher level will be that lower level tests have been completed successfully. At each level, after tests have been completed, ITT will initiate test reports to a) report the results and b) define follow-on activities.

APPENDIX A: DAS REQUIREMENTS OVERVIEW

This appendix provides an overview of NASA's requirements for the DAS. Exhibits A-1 and A-2 provide a summary of the requirements included in the DAS SRD and Concept of Operations, respectively.

REQUIREMENT TYPE	DESCRIPTION
Functional (Section 3.1) and Performance (Section 3.2) Requirements.	• Manage customer interactions (3.1.1 & 3.2.1). • Perform resource management (3.1.2 & 3.2.2). • Perform multiple access return (MAR) beamforming (3.1.3 & 3.2.3). • Perform signal demodulation (3.1.4 & 3.2.4). • Perform return data distribution (3.1.5 & 3.2.5). • Manage the interface between the DAS and WSC system (3.1.6 & 3.2.6). • Provide for modular expansion (3.1.7 & 3.2.7).
Interface Requirements (Section 3.3)	• Provide a DAS - Customer interface (3.3.3). • Provide a DAS - WSC interface (3.3.4). • Provide a DAS – SWSI interface (3.3.1). • Provide a local control & monitor (LCM) capability (3.4).
RMA Requirements (Section 4)	• Compute reliability based on predicted failures in a 10-year life cycle (4.1). • Provide an MTTR not exceeding 30 minutes during the 10-year das lifetime and a maximum TTR not exceeding one hour at the 90th percentile of failures (4.2). • Provide inherent availability of 0.995 over any 10,000-hour period (4.3). • Provide operational availability for each DAS MA customer service > 0.9999 (4.4).
Equipment Design & Construction Requirements. (Section 5)	• Meet requirements for electronic equipment, racks, cabling and connectors, and electromagnetic interference (EMI) as specified in NASA documents.
Installation Requirements. (Section 6)	• Perform installation, site preparation, and equipment installation as specified in NASA documents.
Document Requirements (Section 7)	• Develop and deliver documents as specified in the das data requirements list (DRL) and data item descriptions (DIDS).
Training Requirements (Section 8)	• Perform DAS operator and maintainer training.
Maintenance Requirements (Section 9)	• Develop operation and maintenance manuals as specified in NASA documentation to operate and maintain DAS hardware and software.
Spares Requirements (Section 10)	• Develop the spares requirements for initial provisioning. • Provide technical data to support the procurement of replenishment spares. • Ensure high probability of spares availability over the 10-year DAS lifetime.
Security (Section 11)	• Conform to NASA NPG 2810.1 for securing MISSION Information. • Conform to WSC Security Manual for operations within the Level II Security Boundary and establish connectivity via SWSI and NISN Secure Gateway via the Closed IONet only. • Limit access to customer data to the specific customer and WSC O&M personnel only.

Exhibit A-1: DAS Product Requirements in the SRD

REQUIREMENT TYPE	DESCRIPTION
Functional Requirements (Section 2.2)	• Manage customer interactions (2.2.1). • Perform resource management and control (2.2.2). • Perform multiple access return (MAR) beamforming (2.2.3). • Perform signal demodulation (2.2.4). • Perform data archiving, routing, and retrieval (2.2.5).
Interface Requirements (Section 3)	• Provide a DAS - Customer POCC interface (3.1.c). • Provide a DAS - WSC legacy system interface (3.1.a). • Provide a local control & monitor (LCM) capability (3.1.b. • Provide interfaces to the Internet and an I/O net (3.1.d).
Operational Requirements (Section 4)	• Receive resource requests, emitter ephemeris data and visibility information, reconfiguration requests, and status requests from the customer (4.1). • Send acknowledgments and status of requests, resource allocation assignments, resource availability, and real-time service status and performance to the customer (4.1). • Control DAS internal interfaces, interactions with customer, and interfaces with WSC legacy systems (4.2). • Perform beamforming functions as directed via the DAS control interface; receive and acknowledge configuration commands; receive ephemeris data; receive MA element signals via the Element Multiplexer Correlator interface; transmit formed beams for correlation and to non-DAS elements; and provide status to the DAS control element (4.3). • Perform demodulation functions as directed via the DAS control interface; receive and acknowledge configuration commands; receive formed beams; process customer signals; interface with the DAS data archiving and routing elements; and provide status to the DAS control element (4.4). • Perform data processing functions as directed via the DAS control interface; interface with the demodulating element; route customer data to the customer; archive and retrieve data as specified by the customer; ensure compatibility with CCSDS and IP data transport standards; and provide status to the DAS control element (4.5). • Perform resource allocation accounting to include the allocation and use of resources, verification that customer data was transmitted, and data quality (4.6).
Operational Scenario Requirements (Section 5)	• Perform pre-mission planning with customers including loading and RF analyses (5.1.1). • Perform service request planning with the customer (5.1.2). • Take action on customer service requests (5.2). • Allocate the required resources to provide the requested service (5.3). • Implement the requested service as scheduled (5.4). • Terminate the requested service as scheduled (5.4). • Retrieve and distribute customer data as requested by the customer (5.5).
QoS Monitoring & Accounting (Section 5.6)	• Perform QoS monitoring (5.6.1). • Perform service accounting functions (5.6.2).
Customer Requirements. (Section 6)	• Provide DAS support for a range of customer scenarios including continuous, SOS, periodic, intermittent/on demand, polling, and formation flying.
Operations and Maintenance Requirements. (Section 7)	• Provide for automatic operation of DAS (7.1). • Provide DAS maintenance consistent with the defined maintenance concept (7.2), levels of maintenance (7.3), and types of maintenance (7.4).
Security Requirements (Section 8)	• Provide appropriate security for the DAS.

Exhibit A-2: DAS Product Requirements in the Concept of Operations

APPENDIX B: DAS CONTRACT WORKDOWN STRUCTURE DICTIONARY

WBS	Title	Description
A	**Program Management**	
AA	**Program Management**	
AAA	Program Manager	Represents the time and cost for management of the DAS program over the full term of the contract. Includes: Leading program execution; Providing program review and oversight; Being the primary interface with the customer; Maintaining cost and schedule control; Supervising the efforts of Program Chief Engineer. Develops and delivers: DID 1, Product Management Plan; DID 4, Product Schedule; and DID 5, Monthly Status Reviews.
AB	**QA/CM Management**	
ABA	QA/CM Manager	Represents the time and cost for management of the DAS QA/CM program over the full term of the contract. Includes: Ensuring DAS program quality assurance (QA) and configuration management (CM) tasks are conducted in accordance with the ITT AES Reston C&E Systems Lab Quality Manual; Defining items and dates for placement under formal configuration control; Formally releasing all items under configuration control for delivery to the customer; Recording and distributing changes resulting from Configuration Control Board (CCB) actions; Maintaining the configuration baseline and performing status accounting; and Submitting the ITT Quality Manual for NASA approval in lieu of: DID 2, Configuration Management Plan, and DID 3, Quality Assurance Plan.
AC	**Parts Management**	
ACA	Purchased Parts Manager	Represents the time and cost for management of the DAS purchased hardware and software control program over the full term of the contract. Includes: Compilation and availability of a complete list of parts purchased for the DAS product; Maintenance of a list of long-lead items and deliverable spares; The on-time placement of orders for purchased parts; Maintenance of the files reflecting the status of purchase orders, order receipts, inventory, and issuance; and Maintenance of the status of budgeted versus actual costs of purchased parts.

B	Systems Engineering	
BA	**System Design**	
BAA	System Design	Represents the time and cost for management of the DAS system design efforts over the full term of the contract. Includes: Development and maintenance of the System Design Architecture; Allocation of system requirements to subsystems and to hardware and software configuration items (CIs); Conducting internal and customer requirements and design reviews; and Development and delivery of DID 6, Detailed System/Subsystem Specification, and DID 15, Deviation and Waiver Requests.
BAB	Subsystem Design	Represents the time and cost for management of the DAS subsystem design efforts over the full term of the contract. Includes: Development and maintenance of the Subsystem Design Architecture; Derivation and maintenance of subsystem and hardware and software configuration items (CI) requirements; and Conducting internal requirements and design reviews.
BAC	Internal ICD Development	Represents the time and cost for management of the DAS internal Interface Control Documentation efforts over the full term of the contract. Includes: Development and maintenance of the subsystem interface requirements; Conducting internal design reviews; and Development and delivery of DID 7, Internal DAS Interface Control Document.
BAD	Design Review	Represents the time and cost for conducting customer requirements and design reviews.
BB	**Requirements & ICD Management**	
BBA	SRD Management	Represents the time and cost for management of all external system requirements.
BBB	External ICD Management	Represents the time and cost for management of all external interface documents.
BC	**Systems Analysis**	
BCA	RMA Analysis	Represents the time and cost for performance of system reliability, maintainability, and availability (RMA) assessments and to develop and deliver DID 16, RMA Analysis Report.
BCB	ILSP Analysis	Represents the time and cost for performance of system integrated logistics support assessments and to develop and deliver DID 19, Integrated Logistic Support Plan (ILSP).
BD	**System Verification**	
BDA	Performance Verification Matrix	Represents the time and cost to conduct of system level performance verification analysis and to develop and deliver DID 12 - Performance Verification Matrix.
BDB	Test Plan	Represents the time and cost to develop the DAS Master Test Plan and to develop and deliver DID 11, Test Plan and Procedures.
BDC	Test Procedures	Represents the time and cost to develop the DAS Master Test Procedures and to update DID 11, Test Plan and Procedures.
BDD	Test Reports	Represents the time and cost to develop DID 13 - Acceptance Test Report and DID 14, Inspection and Analysis Report.

C	Hardware Engineering	
CA	**Hardware Design**	
CAA	Drawing Package	Represents the time and cost to develop the hardware drawing tree and to develop and deliver DID 9 - Hardware Design Drawings, which includes a full technical data package suitable for re-procurement.
CB	**Demodulator Group Development**	
CBA	DMU/DMG Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of Demodulator Unit (DMU) and DMU Group (DMG) chassis component designs and integration plans; and establishment of the DMU/DMG CI test requirements.
CBB	DMU/DMG Development	Represents the time and cost to develop the hardware and embedded software for the DMU and DMG and to develop and deliver DID 8 - Software Design Documentation for the DMG CI
CBC	DMU/DMG Integration	Represents the time and cost to test the hardware and embedded software for the DMU and DMG.
CC	**Rack Level Development**	
CCA	Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of component designs and COTS integration plans; and establishment of CI test requirements for the following CIs: IF Switch (Qty 2); Mechanical & Power (as needed for WSGT and GRGT); Frequency and Timing (as needed for WSGT and GRGT)
CCB	COTS Integration	Represents the time and cost to integrate and unit test the following CIs: IF Switch (Qty 2); Mechanical & Power (as needed for WSGT and GRGT); Frequency and Timing (as needed for WSGT and GRGT).
CD	**F.O. Switch Development**	
CDA	Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of component designs and COTS integration plans; and establishment of CI test requirements for the EMC Interface (Qty 1 - WSGT only).
CDB	Hardware	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of the Optical Switch design as a custom integration of COTS items; and establishment Optical Switch and CI test requirements for the EMC Interface (Qty 1 - WSGT only).
CDC	Integration	Represents the time and cost to integrate and unit test the EMC Interface CI.

D	Software Engineering	
DA	**ICON Update**	
DAA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of an updated IBUG Controller design to interface with the DAS Controller and COTS IBUGs; establishment of the updated IBUG Controller test requirements; and development and delivery of DID 8 - Software Design Documentation for the ICON CI.
DAB	CSC/CSU Coding	Represents the time and cost for coding the ICON CI.
DAC	CSC Testing	Represents the time and cost for unit testing of the ICON CI.
DB	**ECON Update**	
DBA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of an updated EMC Controller design to interface with the DAS Controller; establishment of the updated EMC Controller test requirements; and development and delivery of DID 8 - Software Design Documentation for the ECON CI.
DBB	CSC/CSU Coding	Represents the time and cost for coding the ECON CI.
DBC	CSC Testing	Represents the time and cost for unit testing of the ECON CI.
DC	**Customer Interface**	
DCA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of a DAS to SWSI interface message structure; establishment of the customer interface database within the DAS Controller CI; and establishment of the DAS-SWSI test requirements.
DCB	CSC/CSU Coding	Represents the time and cost for coding the DAS SWSI Interface CI.
DCC	CSC Testing	Represents the time and cost for unit testing of the DAS-SWSI Interface CI.
DD	**DAS Controller**	
DDA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of DAS Controller design and interface design with the DAS-SWSI Interface Module and ICON, ECON, DCON controllers and the Archive/Server; establishment of the DAS Controller test requirements; and development and delivery of DID 8 - Software Design Documentation for the DASCON CI, including the DAS-SWSI interface module.
DDB	CSC/CSU Coding	Represents the time and cost for coding the DAS Controller CI.
DDC	CSC Testing	Represents the time and cost for unit testing of the DAS Controller CI.
DE	**DMG Controller (DCON)**	
DEA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of a DMG Controller (DCON) design and its interface with the DAS Controller; establishment of the DCON test requirements; and development and delivery of DID 8 - Software Design Documentation for the DCON CI.
DEB	CSC/CSU Coding	Represents the time and cost for coding the DCON CI.
DEC	CSC Testing	Represents the time and cost for unit testing of the DCON CI.
DF	**DAS Archive/Server (DSER)**	
DFA	CSC/CSU Design	Represents the time and cost for analysis of allocated system/subsystem requirements; establishment of an DAS Archive/Server (DSER) design and its interface with the DAS Controller; establishment of the DSER test requirements; and development and delivery of DID 8 - Software Design Documentation for the DSER CI.
DFB	CSC/CSU Coding	Represents the time and cost for coding the DSER CI.
DFC	CSC Testing	Represents the time and cost for unit testing of the DSER CI.

E	Systems Integration	
EA	**Factory Integration**	
EAA	System Integration	Represents the time and cost to integrate and conduct engineering tests on all HW and SW CIs; to develop Factory Acceptance Test requirements; and to document integration tests as required to demonstrate compliance with NASA requirements; and develop necessary test data and items to be included in DID 13, Acceptance Test Report and DID 14, Inspection and Analysis Report.
EAB	Factory Acceptance Test	Represents the time and cost to conduct factory acceptance tests on the integrated system and to document FAT results as required to demonstrate compliance with NASA requirements.
EAC	Packing & Shipping	Represents the time and cost to pack and ship the integrated system to WSC and GRGT.
EB	**Emulators/Simulators**	
EBA	Design	Represents the time and cost to design the needed emulation and simulation capabilities to support successful integration testing and system verification.
EBB	Develop	Represents the time and cost to integrate the needed emulation and simulation capabilities.
EBC	Verify	Represents the time and cost to verify the accuracy the needed emulation and simulation capabilities.

F	**System Deployment**	
FA	**Installation Planning**	
FAA	WSC Plan	Represents the time and cost to plan, develop and coordinate DID 10, WSC Site Preparation and Installation Plan.
FAB	GRGT Plan	Represents the time and cost to plan, develop and coordinate DID 10, GRGT Site Preparation and Installation Plan.
FB	**Installation Oversight**	
FBA	WSC	Represents the time and cost to provide installation oversight and support services in accordance with the WSC Installation Plan.
FBB	GRGT	Represents the time and cost to provide installation oversight and support services in accordance with the GRGT Installation Plan.
FC	**Field Test Oversight**	
FCA	WSC	Represents the time and cost to provide Acceptance and Network Test oversight at WSC in accordance with the Test Plan and to develop the test results data for inclusion in the Test Report.
FCB	GRGT	Represents the time and cost to provide Acceptance Test oversight at WSC in accordance with the Test Plan and to develop the test results data for inclusion in the Test Report.
G	**Support Engineering**	
GA	**O&M Manual Development**	
GAA	System Manual	Represents the time and cost to develop, coordinate and deliver DID 17, DAS Operations and Maintenance Manual to Level 0 and Level 1 detail.
GAB	DMG Manual	Represents the time and cost to develop, coordinate and deliver DID 17, Demodulator Group Operations and Maintenance Manual to Level 0, Level 1 and Level 2 detail.
GB	**Training**	
GBA	Training Plan	Represents the time and cost to develop, coordinate and deliver DID 18, DAS Training Plan and Material.
GBB	Training Material	Represents the time and cost to develop, coordinate and deliver the Level 0, Level 1 and Level 2 training material for DID 18, DAS Training Plan and Material.
GBC	On-site Training	Represents the time and cost to provide the Level 0 and Level 1 and Level 2 training at both WSC and GRGT and the Level 0 training at WSC.
GC	**Spares**	
GCA	Production	Reserved.